



PORTSMOUTH INFORMATION RELEASE APPROVAL REQUEST

I. Document / Information Description

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ID Number: _____

Originated Date: May 19, 2008

Document Title or Identification: Report Concerning Assumptions, Basis of Estimate,

Original Author(s) / Organization: PTAC Technical Scope

Technical Editor(s) / Organization: PTAC

Format: ☒ Document 20 Total # Pages ☐ Transparencies / Presentations
☐ Photos: _____ # Prints ☐ Electronic Media: TPP

Audience: ☐ Public Meeting ☐ Private Meeting ☐ Presentation to Congress
☐ Distribution List ☐ Internet Publication ☒ Publication/Press Release

Justification: DOE to put on D&D RFP website

Requestor: Amanda Mayo Date: 8.22.08
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**Portsmouth and Paducah Gaseous Diffusion Plant
Decontamination and Decommissioning Estimate**

***Report Concerning Assumptions, Basis of Estimate,
And Technical Scope for the Estimate***

May 19th, 2006

Prepared For:
U.S. Department of Energy
Portsmouth Gaseous Diffusion Plant
Piketon, Ohio

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Reviewer (Signature) R. L. Cordell
Date 2-27-09

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Project Enhancement Corporation



US Army Corps
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1.0 Introduction

The Department of Energy (DOE) at Portsmouth has arranged with the U.S. Army Corps of Engineers – Huntington District (USACE) to develop preliminary cost estimates for the Portsmouth Decontamination and Decommissioning (D&D) Project. The USACE Team consists of personnel from the Corps, Project Time & Cost, Inc., TLG Services, Inc., and Project Enhancement Corporation. The USACE Team was tasked by DOE to develop preliminary estimates, schedules, and other deliverables for six D&D scenarios for Portsmouth.

The Portsmouth D&D Project assumes the decontamination and decommissioning, including demolition, of 134 facilities at the Portsmouth Gaseous Diffusion Process (GDP) plant near Piketon, Ohio. The 134 facilities comprise nearly 10,600,000 square feet of floor space.

The six scenarios are being developed to support the DOE's effort in reaching the Critical Decision-1 (CD-1) milestone requirements for the Portsmouth D&D Project and to provide data for their triennial report to Congress on the D&D Fund. The technical scope, basis of estimate, and assumptions in this report are in support of only Scenario I.

The development of the Scenario I estimate employs modeling, bottoms up estimating, and level-of-effort (LOE) estimating techniques to determine the costs involved in the demolition of the process facilities buildings; the radiation contaminated ancillary buildings, and non-contaminated ancillary facilities (including utilities and infrastructure items.)

2.0 Technical Scope

2.1 D&D of Facilities, Infrastructure, and Utilities

The technical scope includes the demolition of buildings, utilities, and infrastructure at the Portsmouth site that were constructed to perform and support the gaseous diffusion process. A thorough inventory of the type and number of facilities to be included in the cost estimate was performed by the team prior to beginning the estimating process. The D&D estimate accounts for 134 facilities that total 10,550,348 gross square feet (GSF) and is summarized below:

Category	Sub-Category	Construction Type	Gross Area (GSF)	Number of Structures
Industrial	Non-Radiological	Concrete	362,623	12
Industrial	Non-Radiological	Wood	37,000	7
Industrial	Non-Radiological	Other	299,654	20
Industrial	Radiological	Concrete	128,852	1
Industrial	Radiological	Other	224,074	5
Laboratory	Radiological	Concrete	179,342	2
Non-Industrial	Non-Radiological	Concrete	36,864	5
Non-Industrial	Non-Radiological	Wood	166,449	7
Non-Industrial	Non-Radiological	Other	674,683	63
Non-Industrial	Radiological	Concrete	245	1
Non-Industrial	Radiological	Other	103,107	5
Process	Radiological	Other	8,337,455	6
Total Facilities			10,550,348	134

Table 2.1 - Summary of Facility Inventory

In addition to the removal of facilities, the D&D estimate includes removal of the utilities and infrastructure items associated with the gaseous diffusion process. These include ditches, fences,

parking lots, roads, tunnels, switchyards, rubble piles, and other ancillary items. These are summarized in the Table 2-2.

Category	Sub-Category	Gross Area (GSF)	Number of Structures
Infrastructure	Ditches	n/a	4
Infrastructure	Fences	n/a	4
Infrastructure	Parking Lots	1,113,500	5
Infrastructure	Pits	750	1
Infrastructure	Roads / Railroads	n/a	6
Infrastructure	Tunnels	n/a	2
Infrastructure	Yards / Pads	55,516	30
Infrastructure	Rubble Piles	n/a	2
Infrastructure	Other	n/a	3
Utilities	Switchyard	n/a	3
Utilities	General Utilities	n/a	49

Table 2.2 - Summary of Infrastructure and Utilities Inventory

2.2 Waste Disposal

The work scope includes the disposal of all waste, except transuranic and liquid, into an onsite Low Level Radioactive Waste disposal cell. The waste acceptance criteria for the onsite landfill is assumed to include RCRA wastes, classified wastes, sanitary wastes, mixed waste, low level radioactive waste, asbestos, and TSCA wastes. The scope does not include the costs to design, construct, operate, close, or monitor the waste disposal cell. Those costs are to be provided to the DOE by an existing DOE contractor.

2.3 Environmental Restoration

The technical scope includes the removal of all building superstructure, concrete slabs on grade, and building foundations including tunnels. The technical scope does not include the

remediation of contaminated soils or groundwater discovered during D&D. The scope includes the removal of no more than three feet of soil around any below grade structure such as footings, tunnels, utilities or foundations.

2.4 Depleted Uranium Tailings

The technical scope does not include the management, conversion, or disposal of depleted uranium tailings. Depleted uranium tailings at each of the gaseous diffusion plant sites are now being addressed by a project that has been specifically designated to construct and operate a facility to convert the depleted uranium into a stable form for long term storage or disposal.

2.5 Project Start Date and Project Phases

The Portsmouth D&D project and the cost estimate have been divided into the following four phases:

Transition – The project is assumed to commence in April 2008. It is assumed that an “owner’s representative” and a “turn-key” D&D contractor will be brought on board at contract award and begin a brief three month transition period which will include activities such as selection of the D&D contractor, organization of the work, and performance of site and regulatory compliance as well as other up-front activities.

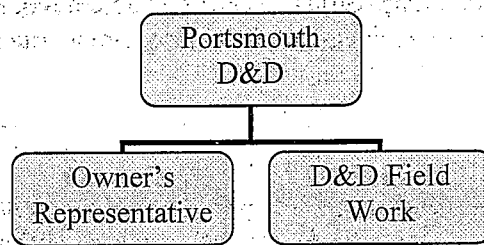
Planning and Preparation – A twelve month period of planning and preparation is assumed to commence after the transition period up to the notice-to-proceed (NTP) for D&D field work. The NTP is assumed to be July 2009, which will coincide with the approval of CD-3: Commence Construction. Activities during the planning and preparation period will include initial mobilization to the site of equipment and personnel, and pre-D&D work for utility and infrastructure modification.

Decontamination, Decommissioning, and Demolition – As noted, commencement of full D&D field work is assumed to be July 2009 and will coincide with approval of CD-3. The D&D phase includes surveillance and maintenance (S&M) for all facilities during the D&D period; the decontamination of equipment and surfaces that contain high hazard radioactivity; asbestos abatement and removal of other toxic materials; removal of hazardous materials such as mercury switches, lube oils, coolant, and other process liquids; removal and disposal of the gaseous diffusion plant equipment; and demolition and disposal of the site structures.

Closeout – Activities required to officially closeout the project including post-D&D characterization; documentation of project completion and lessons learned; and regulatory reporting for site, local, state, and federal regulators.

2.6 Owner’s Representative

The D&D cost estimate is comprised of two primary sections: 1) oversight and management of the project by an “Owner’s Representative” and 2) D&D Field Work. This is illustrated in the diagram below.



Due to the size of the Portsmouth D&D project, the intent of an Owner's Representative is to augment DOE staff by performing a number of critical oversight and regulatory compliance activities. The work scope for the Owner's Representative encompasses S&M activities; regulatory compliance; and critical site functions such as criticality control, health physics, security, and site safety.

The costs associated with the owner's representative are based on a level-of-effort estimating approach utilizing historical data from numerous D&D projects. The total full-time equivalent (FTE) head count for owner's representative activities during each phase are as follows:

- Transition – 55 FTE's
- Planning and Preparation – 90 FTE's
- D&D – 89 FTE's
- Closeout – 66 FTE's

The supporting backup to the headcount assumed during each phase of the project are included as Appendix C to the cost estimate.

2.7 D&D Field Work

The scope of the D&D field work includes the physical deactivation, decontamination, decommissioning, and dismantlement field work that will be performed by a turn-key D&D general contractor selected during the transition phase by DOE and the Owner's Representative. The cost estimate for the D&D field work is based on a combination of parametric cost modeling and bottoms-up estimating. The D&D of the GDP process buildings and ancillary facilities includes the following activities:

- Pre-decommissioning activities such as Operational Readiness Reviews;
- Characterization to determine the type and extent of waste, debris, and hazardous conditions in the buildings;
- Isolation of utilities;
- Construction of redundant utilities where needed;
- Draining of service fluids such as lube oil, coolants, and steam line condensates;

- Removal of loose debris and "junk";
- Removal of asbestos contaminated materials (ACM) such as pipe insulation, siding, and etc.;
- Disassembly and preparation of GDP equipment for burial in the on-site landfill including disconnection of de-energized utilities from the cell assembly, dismantling the cell housing, removal and storage of the converter seals (performed by cleared workers), capping of the process openings on the converters (performed by cleared workers), and hoisting and placing the disconnected converter and remaining cell equipment into the track alleys for transport to the on-site landfill;
- The remaining equipment such as ventilation, the drained lube system, and conduit will be left in place and disposed of during the general building demolition; and
- Demolition of the GDP building structures. The cost estimate breaks the demolition into three phases: demolition of the above ground structure, demolition of concrete slab on grade, and demolition of below ground footings and foundation walls.

All utilities slated for D&D will be disconnected, excavated, and disposed of in the on-site landfill. The quantities of utilities and infrastructure have been calculated from maps and drawings supplied by the DOE and USEC.

3.0 Assumptions

These assumptions have been developed and collected for the purpose of the Portsmouth D&D cost estimate – Scenario I. They have been collected from existing documentation, as well as collaborative analysis performed by the DOE, USACE cost estimating team, and site contractors.

- 1) No reindustrialization.
- 2) The beginning year of the estimate will be FY2006.
- 3) All facilities will be available for immediate D&D.
- 4) The project will be conducted as a non-time critical CERCLA Removal Action.
- 5) A single EE/CA will be prepared to cover both the D&D project and disposal cell construction.
- 6) No recycling of materials (i.e., steel, concrete, uranium deposits, nickel, etc.) will take place. (see Assumption #40)
- 7) Estimate will be broken down into three phases:
 - a. Above ground demolition (structures)
 - b. Slab demolition
 - c. Below ground demolition (footers and foundations)

- 8) Assume depressions from the below ground demolition phase of D&D work will not be backfilled, but will be contoured to resemble the existing lay of the land.
- 9) There will be post D&D characterization and confirmation of completion of the project site.
- 10) Temporary power and systems will be installed as required during the D&D project.
- 11) The cost estimate will not include the costs of contaminated soils or groundwater remediation.
- 12) The cost estimate will not include the costs to design, construct, operate, close, support, or monitor the proposed CERCLA landfill.
- 13) The proposed CERCLA landfill will accept all wastes generated by the D&D project, including Mixed Low Level Wastes (MLLW), Toxic Substances Control Act (TSCA) wastes, Resource Conservation and Recovery Act (RCRA) wastes, Low Level Wastes (LLW), Technetium-99 (Tc-99) contaminated materials, classified wastes, and asbestos containing materials (ACM).
- 14) The proposed CERCLA landfill will not accept liquid wastes, mercury switches, RCRA land banned wastes (such as chlorinated solvents [LDR]), and certain other select hazardous wastes.
- 15) Wastes not accepted by the proposed CERCLA landfill will be shipped off-site for disposal.
- 16) The proposed CERCLA landfill waste acceptance criteria (WAC) will pose no size restrictions that require the reduction of piping or process equipment.
- 17) Every building with a Category II or higher radiological hazard will require an Operational Readiness Review (ORR).
- 18) Each non-radiological building and any radiological buildings that do not meet the Category II or higher hazard rating will require a Readiness Assessment (RA).
- 19) Process equipment will be less than always safe mass (ASM) for criticality, and will not require dismantlement, deposit removal, or decontamination for Building X-333 only.
- 20) Buildings X-330 and X-326 might have some equipment that will require some degree of dismantlement due to having greater than always safe mass deposits. No custom facility will need to be constructed to repetitively dismantle converters to remove greater than safe mass deposits.
- 21) There will be no transuranic radiation concentrations on the site of greater than 100 nCi/g.
- 22) Non-process waste liquids (such as lube oils, coolants, condensate, transformer oil, and etc.) will have to be drained, removed, and disposed of during pre-demolition. As per the earlier Lessons Learned Report, most of these waste liquids will need to be treated as mixed waste, until proven otherwise.
- 23) Exposing penetrations into classified components will require L-cleared workers.
- 24) There will be a requirement for some Q-cleared workers.

- 25) The estimate will assume that non-working cleared escorts will be included at appropriate levels in crews where applicable.
- 26) Once classified components have met safeguard and security concerns, uncleared workers may be used to finish disassembly and disposal.
- 27) All classified components will have been removed before the start of GDP building demolition.
- 28) The primary building demolition equipment will be tracked excavators (such as, CAT 320 or CAT 425) fitted with necessary demolition implements.
- 29) Physical D&D work will be subcontracted.
- 30) For the purposes of disposal, converters will be left empty, with end caps physically adhered in place.
- 31) Disposal cell subsidence (due to vessels and large pipe sections) will be addressed by cell design.
- 32) Segmentation will be utilized for greater than always safe mass (ASM) deposit removal from equipment in building X-326 and X-330 that could not be removed by other means.
- 33) For buildings without excess material inventories, assume the excess materials ratio per square foot in the process buildings.
- 34) Underground utilities will be removed to their distribution point or site boundary where they will be cut and capped.
- 35) Decontamination of structures, to remove hazardous or radioactive contamination, will be limited to that necessary to protect the public and workers from such items as off-site airborne migration during building demolition. Decontamination of waste items to meet disposal cell WAC to be limited to removal of special nuclear material.
- 36) Owner representative to oversee owner's interest in the D&D work scope is included in the estimate.
- 37) Assume contract award by April, 2008 and Notice To Proceed (NTP) for D&D and the cell by July, 2009.
- 38) Assume transition costs will last from April, 2008 to July, 2009.
- 39) Design, construction, and operations of the on-site disposal cell and haul road(s) will be performed by the disposal cell contractor.
- 40) Assume there will be 2,080 paid work hours per year.
- 41) Assume Freon disposal costs (not including labor and materials to drain systems) will be zero due to high recycling market demand.
- 42) (TPMC) DOE will fulfill the obligation for cleanup of contaminated sites resulting from historical uranium enrichment programs.
- 43) (TPMC) S&M will be performed in support of transition to a D&D program and is not intended to be a long-term operation.

- 44) (TPMC) DOE and USEC will reach clear agreements on lease arrangements for the USEC Advanced Centrifuge program in calendar year 2006.
- 45) (TPMC) USEC will continue to be regulated by the NRC and OSHA until the turnover date; on that date, DOE will become responsible for the entire site, either under DOE regulation or outside regulation.
- 46) (TPMC) During deactivation/shutdown period proceeding facility transfers, DOE will not impose or self-perform any work intended to exceed or redefine the turnover requirements as described in Sect. 4.4 of the lease. However, it will be necessary for DOE to perform certain tasks during the performance period to prepare the plant for post-turnover operations. This work includes but is not limited to, providing heat to facilities now heated with steam or waste process heat. Because such work may be in leased space or on leased systems, agreement among DOE, USEC, and NRC will be necessary.
- 47) (TPMC) DOE will complete the required notifications and power negotiations with OVEC prior to completion of transfer.
- 48) (TPMC) Union collective bargaining agreements on workforce transition will be resolved prior to the transfer of the Portsmouth GDP facilities, and will not impact D&D operations.

4.0 Basis of Estimate

This section documents the key features and methods used to develop the Portsmouth D&D estimate.

4.1 Estimating Software

The cost estimate was prepared using MII (MCACES 2nd Generation) software. MII is a robust cost estimating software used by the U.S. Army Corps of Engineers to prepare cost estimates from conceptual through definitive design. MII provides the capability to develop detailed cost estimates for environmental, civil works, military and HTRW projects based upon labor rates, equipment rates, crews, material pricing information, productivity rates and markups. MII can organize an estimate with an unlimited number of work breakdown structure levels.

4.2 Estimate Work Breakdown Structure

The MII estimate has been organized around a user defined 8 "level" Work Breakdown Structure (WBS). The 8 level WBS breaks the project down to an individual facility based on its function, contamination level, and type of construction. Below Level 8, the WBS breaks down the D&D work scope to specific activities comprised of labor, materials, equipment, production rates, and quantities. The WBS to Level 8 is shown in Figure 4.2 for illustrative purposes.

Figure 4.2 - Portsmouth D&D Project - MII Estimate Work Breakdown Structure

Level 1	Portsmouth D&D (<i>Project</i>)
Level 2	Owner's Representative Support
Level 2	D&D Work
Level 3	D&D Management
Level 3	D&D Field Work
Level 4	Facilities (<i>Feature</i>)
Level 5	Industrial Facilities (<i>Facility Category</i>)
Level 6	Non-Radiological (<i>Contamination Level</i>)
Level 7	Concrete (<i>Type of Construction</i>)
Level 7	Other
Level 7	Wood
Level 8	<i>Facility Name and Number</i>
Level 6	Radiological
Level 7	Concrete
Level 7	Other
Level 5	Laboratories
Level 6	Radiological
Level 7	Concrete
Level 5	Non-Industrial Facilities
Level 6	Non- Radiological
Level 7	Concrete
Level 7	Other
Level 7	Wood
Level 6	Radiological
Level 7	Concrete
Level 7	Other
Level 5	Process Buildings
Level 6	Radiological
Level 7	Other
Level 4	Infrastructure
Level 5	Infrastructure
Level 6	Ditches
Level 6	Fences
Level 6	Parking Lots
Level 6	Pits
Level 6	Roads and Railroads
Level 6	Tunnels
Level 6	Yards and Pads
Level 6	Other
Level 6	Rubble Piles

4.3 Labor Rate Development

Labor costs in the MII estimate are based on the following 17 labor classifications which were summarized and simplified from approximately 160 individual labor types:

Professional Labor	Blue Collar Labor
Director and Senior Managers	Superintendent
Project / Department Managers	Foreman
Engineer / Scientist / Subject Matter Experts	Equipment Operator
Supervisors	Laborer
Senior Technicians / Analysts	Asbestos / D&D Worker
Technician / Analysts	Hazardous Material Worker
Administrative Assistants	Truck Driver
Clerical	Escort / Protective Services
-	Craftsman

Specific assumptions regarding labor rate development are provided below:

- The Base Wage Rate and Fringes for D&D labor were taken from the Davis-Bacon Rates, Ohio General Decision, and Pike County, for construction type Building and Heavy dated April 7, 2006.
- The Workers Compensation Insurance Rates were obtained from RS Means Cost Data Table, Worker's Compensation Insurance Rates by Trade and State, Ref: R.S. Means, General Requirements, Table: R011-Overhead & Miscellaneous Data, Updated Year: 2005. The additional payroll insurance and taxes are assumed to be the average national rate.
- A Foreman's Base Wage Rate and Fringe were assumed to be 25% higher than a Laborer.
- The Management/Support Staff's salaries and fringes were obtained using the Salary Wizard Database at www.salary.com. The Salary Wizard is used by the job search sites such as Monster.com, Hotjobs.com, and Careerboard.com. In addition, Salary.com can be reached through the AACE website: <http://www.aacei.org/>. The Workers Compensation Insurance Rates for Management/Support Staff was assumed to be 5%.
- Per Diem Rate was obtained from the US General Services Administration Website at www.gsa.gov. The Per Diem Rates were only applied to Management Staff and Foreman.

4.4 Estimating Approach

The estimating approach utilized includes a combination of "Bottoms-Up", Parametric Cost Modeling, and Level-of-Effort approaches.

A Level-of-effort, or LOE, based estimating approach was used to estimate labor costs for professional and managerial labor associated with the Owner's Representative and D&D management and integrated support work elements of the project. LOE based estimates are acceptable for tasks that are not easily broken down into activities or tasks that require a minimum staff level regardless of the workload. The types of tasks selected for LOE based estimating include items such as criticality control, structural engineering, regulatory compliance (both on-site compliance, as well as local, state, and federal governmental compliance), health physics, safety, site security, and other centrally controlled project functions. The staffing positions were populated in the MII estimate by the anticipated staffing levels necessary to perform the needed function.

The D&D Field Work for the 134 buildings was estimated using a combination of parametric cost modeling and bottoms-up estimating approaches. The team obtained information regarding building size, building function, contamination level, and construction type from DOE and the FIMS database. From there the buildings were grouped into similar categories resulting in 12 possible variations based on the building categorization. These categories formed the basis for the development of parametric cost models used to estimate the D&D field work.

Due to the unique nature of D&D work, there were 20-30 facilities, known as "outliers" that did not fit neatly into building category types and were estimated by making adjustments for these unique facilities. The generic building category types are illustrated in the table below:

Building Usage	Radioactive Contamination	Structure Type
GDP Process Building	Radiological Contamination	Concrete
Laboratory	Non-Radiological Contamination	Wood
Industrial Facility		Other
Non-Industrial Facility		

Table 3 - Building Categories Used for Parametric Model Types

After categorizing the facilities into generic model types, nine primary D&D field work tasks were developed for each model type and included as part of the estimate WBS below the Facility Level. For each of these primary D&D field work tasks, a crew comprised of labor, equipment, and material resources with a production rate was created to perform each task. Note that the

crew makeup and production rate varied by model type due to level of contamination, type of construction, and etc. The primary D&D field work tasks used for each model are illustrated below:

Primary D&D Field Work Tasks

- Characterization
 - *Characterization Crew with labor, equipment, material, production rate*
- Junk Removal
- Utility Isolation
- Decontamination (if needed)
- Equipment Removal
- Asbestos Abatement
- Above Ground Demolition
- Slab on Grade Demolition
- Below Grade Demolition

Based on a combination of quantity takeoffs performed from drawings, field walk downs, and historical information, a cost engineering relationship (CER) or algorithm was developed that related the total quantity of each work item to the gross square foot area of the building or other parameter. Over 900 drawings were obtained for the Portsmouth GDP facility from which quantity takeoffs were performed. In the case of the GDP buildings these drawings combined with walk downs of the facility helped to develop a detailed bottoms up estimate of representative sections of each GDP building. These representative sections were then extrapolated to building as a whole, as each building GDP system is repetitive in nature.

The crew hours for each individual work item were then produced by dividing the quantity for each work item by the crew production rate. From the crew hours, the individual man-hours for each labor resource and piece of equipment were produced and loaded into MII where the resulting costs were generated.

Debris and waste volumes were produced independently from previously waste volume studies by SAIC and others. These sources were used as benchmarks, but the team produced waste volumes from field walk-downs, quantity takeoffs, and the use of cost engineering relationships that relate debris quantities for each activity using specific assumptions (for example: 0.67 ft³ of slab on grade per GSF of building area).

4.5 Contractor Markups

The following contractor markups have been included in the MII estimate:

- *Owner' Representative*
 - Field Office Overhead – based on detailed staffing plans
 - Home Office Overhead - 5%
 - Profit - 10%
- *D&D Contractor*
 - Field Office Overhead – based on detailed staffing plans
 - Home Office Overhead – 7%
 - Profit - 15%
- Sales Taxes – 7%
- The estimate has been escalated to 2007 dollars.
- Contingency is not included.

A Appendix

Slab removal was based on the engineering method used for the reconstruction of Runway 9R-27L at Hartsfield-Atlanta International Airport in September 1999. Runway 9R-27L was sawed into 21,150 panels, each measuring 12 by 7.5 feet with a thickness of 16 to 22 inches and containing 1" diameter rebar. The Penhall Company performed the saw cutting. Six Cat 345 excavators with slab crabs were used to remove and load the panels onto semi-tractor trailers with flatbeds. The panels were taken to a stockyard for processing into recyclable material. E. R. Mitchell Construction Company performed the slab removal. The reconstruction of Runway 9R-27L at Hartsfield-Atlanta International Airport is explained in detail in Attachments 1 and 2.

Attachment 1:

Gomaco, Inc. explanation of the runway demolition project.

Attachment 2:

ACS Geosciences Technical Paper for the Atlanta Jackson-Hartsfield runway demolition.

B Appendix

Portsmouth Project – Partial Estimating WBS

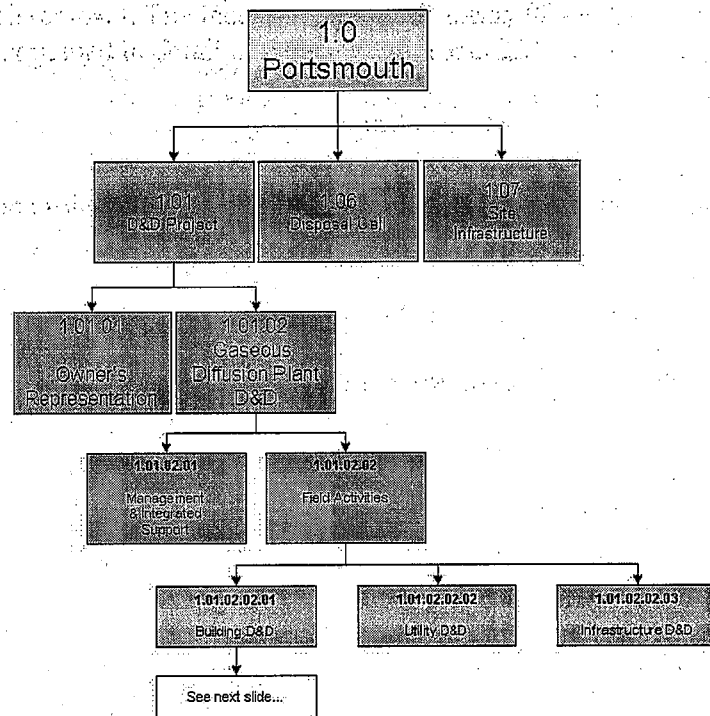


Figure B-1 - WBS Levels 1-5

Portsmouth Project – Partial Estimating WBS

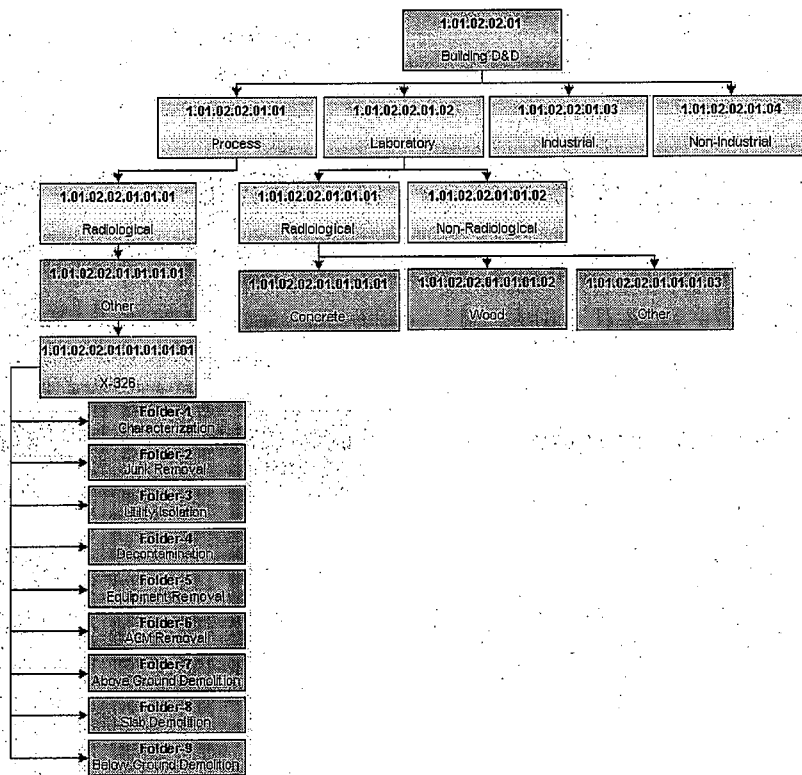


Figure B-2 - WBS Levels 5 - 9

B-2

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